



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/998,683	11/30/2001	Mark J. Halstead	EMS-02302	7367

26339 7590 10/20/2004

PATENT GROUP  
CHOATE, HALL & STEWART  
EXCHANGE PLACE, 53 STATE STREET  
BOSTON, MA 02109

EXAMINER

CHACE, CHRISTIAN

ART UNIT PAPER NUMBER

2187

DATE MAILED: 10/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

09/998,683

**Applicant(s)**

HALSTEAD ET AL.

**Examiner**

Christian P. Chace

**Art Unit**

2187

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 10 September 2004.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-19 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 30 November 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.  
5) ☐ Notice of Informal Patent Application (PTO-152)  
6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Response to Amendment***

This Office action has been issued in response to amendment filed 10 September 2004. Claims 1-19 are pending. Applicants' arguments have been carefully and respectfully considered in light of the instant amendments to the claims, but they are not persuasive. Accordingly, this action has been made FINAL.

### ***Drawings***

The drawings are *again* objected to under 37 CFR 1.83(a). Applicants failed to respond to the previous objection in the previous Office action, which examiner interprets to be an oversight. The drawings must show every feature of the invention specified in the claims. Therefore, the newly added limitations (via amendment filed 14 June 2004, and now amendment filed 10 September 2004) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering

Art Unit: 2187

of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-19 are rejected under 35 U.S.C. 102(b) as being anticipated by Ofek et al (US Patent 5,889,935).

With respect to independent claim 1, a method of reversing a communication path between a first volume on a first storage device and a second volume on a second storage device is disclosed in figure 15 as using either of the volumes as a primary volume. Also, column 34, lines 60-64 recites reversing the roles of the R1 and R2 volumes, thereby reversing the communication path, as the host would then directly access the R2 volume and mirror to the R1 volume.

Suspending communication between the first and second volumes while maintaining operations for other volumes of the storage devices is disclosed in figure 15, #480 as suspending host processing with the R1 volume. If host processing is suspended with the R1 volume, then there is nothing to mirror to the R2 volume, so

Art Unit: 2187

communication is inherently suspended to that volume as well. As #480 solely discloses suspension of operations for R1 and R2 (as discussed supra), it is implicitly anticipated that no other volumes are affected by the suspension.

Causing the first volume to change from a source volume to a destination volume without destroying the first volume and causing the second volume to change from a destination volume to a source volume without destroying the second volume is disclosed in figure 15 as using either of the volumes as a primary volume. Both volumes are merely synchronized, not destroyed. Also, column 34, lines 60-63 discuss the role reversal of the two volumes. The primary volume is the source volume, and the secondary volume is the destination volume, before reversal. Once reconfigured, the secondary volume is the source volume, as it would be directly accessed by the host, and the primary volume is the destination volume, that would be remotely mirrored to from the source volume.

Resuming communication between the first and second volumes and resuming data access operations to the first and second volumes after causing the first volume to change from a source volume to a destination volume and causing the second volume to change from a destination volume to a source volume, prior to synchronizing the volumes, wherein, in response to a data access operation to the second volume, and valid data for the access operation existing only in the first volume, the data access operation to the second volume is satisfied by accessing data from the first volume is disclosed in column 10, lines 39-47, which discusses access commands going to the accessible device (volume) and synchronizing later when the original device becomes

available again. Ofek et al literally recite, "Accordingly, each data storage device keeps data validity information about its mirrored device. If for some reason a device is not accessible, either the primary or the secondary device, every new write command goes to the accessible mirrored device along with information that the not accessible device has a track that is not valid. As soon as the non-accessible device becomes accessible, then, as a background operation, the drives re-synchronize."

It is important to note that the claim language does not necessarily require the "resuming data access operations to the first and second volumes" to occur prior to synchronizing the volumes. The claim limitations have been read and interpreted as follows:

"Resuming communication between the first and second volumes and resuming data access operations to the first and second volumes after causing the first volume to change from a source volume to a destination volume and causing the second volume to change from a destination volume to a source volume"

"and"

"Prior to synchronizing the volumes, wherein, in response to a data access operation to the second volume and valid data for the data access operation existing only on the first volume, the data access operation to the second volume is satisfied by accessing data from the first volume."

However, allowing access to one of the volumes (either one, meaning both in general – applicants do not specify that two accesses occur at the same time) prior to synchronization is disclosed as a data access operation, such as a "read" is allowed

Art Unit: 2187

before synchronization completes, as discussed in column 3, lines 47-50, as well as in column 12, line 67 into column 13, line 4.

It is also important to note that column 10 discusses the remote mirroring facility in general, while referring to figure 1 and 4. Column 34 discusses data migration in the remote mirroring facility discussed in column 10. See column 33, line 40, e.g.

With respect to claims 2, 9, and 15, causing the first volume to change from a source volume to a destination volume including modifying a table of the first storage device is disclosed in column 33, line 60 into column 34, line 17, as shown in figure 14. The table is the bitmap array, and the modification of that table occurs in steps #472 and #473.

With respect to claims 3, 10, and 16, causing the second volume to change from a source volume to a destination volume including modifying a table of the second storage device is disclosed in figure 14, #476 and #477. Again, the table is the other half of the bitmap array (as opposed to the first half discussed supra with respect to claims 2, 9, and 15), and the switching and copying in those steps is the modification of that table.

With respect to claims 4, 11, and 17, suspending communication including setting the first volume to a "not ready" state is disclosed in figure 15, #480 as suspending host processing to the R1 volume. If processing is suspended, then, inherently, communication is suspended, as communication is "processing" and *vice-versa*. Also, if there is no processing there is nothing to communicate.

With respect to claims 5, 12, and 18, resuming communication including setting the second volume to a "ready" state is disclosed in column 34, lines 62-63, which discloses the host directly accessing the R2 volume, which is the secondary volume.

With respect to claims 6, 13, and 19, returning a result indicating successfully reversing the communication path is disclosed in figure 15 as processing resuming using either of the volumes as a primary volume. Accordingly, if the R2 volume is, indeed, being used as the primary volume, and processing resumes, then the communication path has inherently been successfully reversed.

With respect to independent claim 7, a method of managing volumes on storage devices is disclosed in the title as remote data mirroring.

Receiving a command requesting reversal of a communication path between a first volume on a first storage device and a second volume on a second storage device is not only inherent, as a communication path is reversed, as will be discussed below, and a computer must, inherently be commanded to do something; but it is also disclosed in figure 14 as "migrate active volume."

Suspending communication between the first and second volumes while maintaining operations for other volumes of the storage devices is disclosed in figure 15, #480 as suspending host processing with the R1 volume. If host processing is suspended with the R1 volume, then there is nothing to mirror to the R2 volume, so communication is inherently suspended to that volume as well. As #480 solely discloses suspension of operations for R1 and R2 (as discussed supra), it is implicitly anticipated that no other volumes are affected by the suspension.



Causing the first volume to change from a source volume to a destination volume without destroying the first volume and causing the second volume to change from a destination volume to a source volume without destroying the second volume is disclosed in figure 15 as using either of the volumes as a primary volume. Both volumes are merely synchronized, not destroyed. Also, column 34, lines 60-63 discuss the role reversal of the two volumes. The primary volume is the source volume, and the secondary volume is the destination volume, before reversal. Once reconfigured, the secondary volume is the source volume, as it would be directly accessed by the host, and the primary volume is the destination volume, that would be remotely mirrored to from the source volume.

Resuming communication between the first and second volumes after causing the first volume to change from a source volume to a destination volume and causing the second volume to change from a destination volume to a source volume, prior to synchronizing the volumes, wherein, in response to a data access operation to the second volume, and valid data for the access operation existing only in the first volume, the data access operation to the second volume is satisfied by accessing data from the first volume is disclosed in column 10, lines 39-47, which discusses access commands going to the accessible device (volume) and synchronizing later when the original device becomes available again. Ofek et al literally recite, "Accordingly, each data storage device keeps data validity information about its mirrored device. If for some reason a device is not accessible, either the primary or the secondary device, every new write command goes to the accessible mirrored device along with information that

the not accessible device has a track that is not valid. As soon as the non-accessible device becomes accessible, then, as a background operation, the drives re-synchronize.”

It is important to note that the claim language does not necessarily require the “resuming data access operations to the first and second volumes” to occur prior to synchronizing the volumes. The claim limitations have been read and interpreted as follows:

“Resuming communication between the first and second volumes and resuming data access operations to the first and second volumes after causing the first volume to change from a source volume to a destination volume and causing the second volume to change from a destination volume to a source volume”

“and”

“Prior to synchronizing the volumes, wherein, in response to a data access operation to the second volume and valid data for the data access operation existing only on the first volume, the data access operation to the second volume is satisfied by accessing data from the first volume.”

However, allowing access to one of the volumes (either one, meaning both in general – applicants do not specify that two accesses occur at the same time) prior to synchronization is disclosed as a data access operation, such as a “read” is allowed before synchronization completes, as discussed in column 3, lines 47-50, as well as in column 12, line 67 into column 13, line 4.

It is also important to note that column 10 discusses the remote mirroring facility in general, while referring to figure 1 and 4. Column 34 discusses data migration in the remote mirroring facility discussed in column 10. See column 33, line 40, e.g.

With respect to claim 8, the command being a "single multihop, multiexecute" command that causes operations to be performed on the first and second storage devices is disclosed as "migrate active volume" in figure 14. Page 9, lines 21-23 of the instant specification were looked to in order to define this type of command, as examiner is unfamiliar with the terminology. From the instant citation, "The multihop/multiexecute system command is a single system command that is provided to multiple storage devices and indicates operations to be performed by the multiple storage devices." Accordingly, the "migrate active volume" command is a command in the (single) system that is provided to multiple storage devices (primary and secondary volumes) and indicates operations to be performed by the devices (migration).

With respect to independent claim 14, a computer program product is disclosed in column 33, lines 50-53 as a task using software.

Reversing a communication path between a first volume on a first storage device and a second volume on a second storage device is disclosed in figure 15 as using either of the volumes as a primary volume. Also, column 34, lines 60-64 recites reversing the roles of the R1 and R2 volumes, thereby reversing the communication path, as the host would then directly access the R2 volume and mirror to the R1 volume. This is the active migration referred to in column 33, line 50, which may be implemented in software. Software is, by definition, executable code. Examiner notes

Art Unit: 2187

then, that the claims which depend from the instant claim are also anticipated as discussed supra by the active migration scheme being implanted by software, as discussed instantly.

Suspending communication between the first and second volumes while maintaining operations for other volumes of the storage devices is disclosed in figure 15, #480 as suspending host processing with the R1 volume. If host processing is suspended with the R1 volume, then there is nothing to mirror to the R2 volume, so communication is inherently suspended to that volume as well. As #480 solely discloses suspension of operations for R1 and R2 (as discussed supra), it is implicitly anticipated that no other volumes are affected by the suspension.

Causing the first volume to change from a source volume to a destination volume without destroying the first volume and causing the second volume to change from a destination volume to a source volume without destroying the second volume is disclosed in figure 15 as using either of the volumes as a primary volume. Both volumes are merely synchronized, not destroyed. Also, column 34, lines 60-63 discuss the role reversal of the two volumes. The primary volume is the source volume, and the secondary volume is the destination volume, before reversal. Once reconfigured, the secondary volume is the source volume, as it would be directly accessed by the host, and the primary volume is the destination volume, that would be remotely mirrored to from the source volume.

Resuming communication between the first and second volumes after causing the first volume to change from a source volume to a destination volume and causing

Art Unit: 2187

the second volume to change from a destination volume to a source volume, prior to synchronizing the volumes, wherein, in response to a data access operation to the second volume, and valid data for the access operation existing only in the first volume, the data access operation to the second volume is satisfied by accessing data from the first volume is disclosed in column 10, lines 39-47, which discusses access commands going to the accessible device (volume) and synchronizing later when the original device becomes available again. Ofek et al literally recite, "Accordingly, each data storage device keeps data validity information about its mirrored device. If for some reason a device is not accessible, either the primary or the secondary device, every new write command goes to the accessible mirrored device along with information that the not accessible device has a track that is not valid. As soon as the non-accessible device becomes accessible, then, as a background operation, the drives re-synchronize."

It is important to note that the claim language does not necessarily require the "resuming data access operations to the first and second volumes" to occur prior to synchronizing the volumes. The claim limitations have been read and interpreted as follows:

"Resuming communication between the first and second volumes and resuming data access operations to the first and second volumes after causing the first volume to change from a source volume to a destination volume and causing the second volume to change from a destination volume to a source volume"

"and"

“Prior to synchronizing the volumes, wherein, in response to a data access operation to the second volume and valid data for the data access operation existing only on the first volume, the data access operation to the second volume is satisfied by accessing data from the first volume.”

However, allowing access to one of the volumes (either one, meaning both in general – applicants do not specify that two accesses occur at the same time) prior to synchronization is disclosed as a data access operation, such as a “read,” is allowed before synchronization completes, as discussed in column 3, lines 47-50, as well as in column 12, line 67 into column 13, line 4.

It is also important to note that column 10 discusses the remote mirroring facility in general, while referring to figure 1 and 4. Column 34 discusses data migration in the remote mirroring facility discussed in column 10. See column 33, line 40, e.g.

### ***Response to Arguments***

With respect to applicants’ first argument on page 12 of the instant remarks, that Ofek does not disclose, “a mechanism of resuming operation without first synchronizing the R1 and R2 volumes when the R1 and R2 volumes have been swapped,” examiner respectfully submits that the instant argument is not commensurate with the claim language.

With respect to applicants’ argument on page 13 of the instant remarks, that the disclosure at column 10 of Ofek teaches operations to be performed if one or the other of the primary or secondary [volumes] fail, and, therefore, has “nothing to do with swapping R1 and R2 as disclosed by Ofek at column 34.” Even assuming, *arguendo*,

that a reference may be taken piecemeal as applicants discuss, examiner still respectfully disagrees. The whole reason for swapping in Ofek is recovery of a failure of a volume, as disclosed by Ofek in column 33, lines 23-24. The synchronization disclosed at column 10 of Ofek relates to the synchronization that takes place after the source of the failure is remedied (as applicants' discuss), and that remedy is swapping. Accordingly, there is a failure, access continues through the recovery process (swapping, or "data migration,") and then the volumes are synchronized. This clearly anticipates the claim language as it stands.

With respect to applicants' argument on page 13 of the instant remarks that there is no teaching in Ofek regarding allowing data accesses to R1 or R2 during the swap process or how to perform the swap process without first having to synchronize R1 and R2, examiner respectfully disagrees. This is not commensurate with the claim language. The claim language requires, "resuming communications...**after** causing the first volume to change from a source volume to a destination volume..." (emphasis added). This is anticipated by the column 10 citation of Ofek. The claim language then goes on to require the data access operation to the second volume being satisfied by accessing data from the first volume prior to synchronization. This is also anticipated by the column 10 citation. The swapping, or role reversal is discussed in the column 34 citation, with data migration (swapping) being a reason a device is not accessible, as disclosed in column 10, lines 41-42.

This segues into applicants' argument at the bottom of page 14, where applicants argue that it is not clear how one would apply the...mechanism described in column 10 of Ofek to the ...swapping mechanism described by Ofek in column 34."

It is also important to note that the system of Ofek operates in either of two modes, synchronous or asynchronous. As discussed in column 9, lines 17-19, "Since primary and secondary data are not synchronized, however, the primary data storage system must maintain a log file of the pending data which has yet to be written to the secondary data storage device," as disclosed by applicants with respect to the instant specification at page 15 as well as in their discussion of figure 3 at page 14 of the instant remarks. Also, the system may operate in adaptive copy – write pending mode, which is discussed in column 18, lines 45-60.

Accordingly, even assuming *arguendo*, that applicants' interpretation of the claim language is correct (that the resuming communication and data access operations is also prior to synchronization), and examiner is mistaken (that the resuming communication and access is merely required to be after swapping, and that the data access operation (read) to the second volume being satisfied by the first is prior to the synchronization, separate and at another time than swapping), column 35, line 28 into column 36, line 32 discusses the migration task in adaptive copy mode, where it is possible that host processing may continue during the migration (swapping) process, particularly discussed in column 35, lines 48-51, for example.

### **Conclusion**



**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christian P. Chace whose telephone number is 703.306.5903. The examiner can normally be reached on 9-4-5.

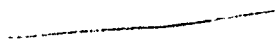
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Donald Sparks can be reached on 703.308.1756. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2187

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'C. P. Chace', followed by a horizontal line.

Christian P. Chace

A single horizontal line drawn in black ink.